Mobile Application Development Project

MTAT.03.266

Spring 2018

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Course Purpose

• Practice the mobile application development
• Apply well-known techniques to develop applications for the mobile devices
• Glance of research at Mobile & Cloud Lab

• https://courses.cs.ut.ee/2018/MADP/spring
Questions

• Have you ever programmed for mobile devices?
  – This course assumes you have experience with at least one mobile technology
  – Or you have taken MTAT.03.262 Mobile Application Development course

• Which mobile platforms have you used already?

• How comfortable you are with programming?
  – Java?
    • External APIs?
  – Web programming?

• Have you heard of cloud computing?
Related Courses

• **MTAT.03.262** Mobile Application Development (3 ECTS)
  – Fall 2018

• **MTAT.03.280** Mobile and Cloud Computing Seminar (3 ECTS)
  – Thu. 14.15 - 16.00, Ülikooli 17 - 218

• **MTAT.08.036** Distributed Data Processing on the Cloud (6 ECTS)
  – Fall 2018

• **MTAT.08.027** Basics of Cloud Computing (3 ECTS)
  – Tue. 10.15 – 12.00, J. Liivi 2 - 402
Grading

• No written exam
• Just deliver a project
  – Max 3 persons per group
• Activities
  – Design the application
  – Develop using the platform of your choice; Android is preferred
  – Deliver the project with detailed reports
To pass

- One must attend 80% of the sessions
- Submission of project report
- Final presentation and demonstration
- Max 5 min Video which will be uploaded to youtube
- Source code properly managed
Grading - progress

• Prototype 1 (20%)
  – Presentation (5%)
  – Progress (10%)
  – Punctuality (5%)
• Prototype 2 (20%)
  – Split same as Prototype 1
• Final Presentation (60%)
  – Presentation (10%)
  – Demo (20%)
  – Report (10%)
  – Video/Poster (10%)
  – Managed Source (10%)
• Bonus – People’s Choice (5%)
  – If more than 6 groups
Outline

• Mobile Application Development
• Introduction to the projects
• General discussion and forming groups
Lecture 1

MOBILE APPLICATION DEVELOPMENT
The Seven Mass Media

First Mass Media Channel - Print from the 1500s
Second Mass Media Channel - Recordings from 1900
Third Mass Media Channel - Cinema from 1910s
Fourth Mass Media Channel - Radio from 1920s
Fifth Mass Media Channel - TV from 1950s
Sixth Mass Media Channel - Internet from 1990s
Seventh Mass Media Channel - Mobile from 2000s

Report: Mobile cloud to grow beyond $11 billion in 2018

Written by CooperEgg // July 12, 2012 // No Comment // Cloud Performance

The proliferation of smartphones, tablets and other mobile devices is contributing to change in the private sector, as businesses continue to leverage these gadgets in an attempt to enhance efficiency and potentially gain a competitive advantage. According to a new report by Global Industry Analysts, the evolution of mobility is also changing the cloud computing landscape, pushing the mobile cloud market to generate more than $11 billion in revenue by 2018.

Verizon's Stratton: The Future Of IT Is Mobile And Cloud

2/14/2014
Tomi T Ahonen
Satish Srirama
Popular consumer mobile applications

• Location-based services (LBSs)
  – Deliver services to users based on his location

• Mobile social networking
  – Most popular social networking platforms have apps for mobiles

• Mobile commerce
  – An extension of e-commerce

• Mobile payment
  – Near field communication (NFC) payment
Popular consumer mobile applications - continued

• Context-aware services
  – Context means person's interests, history, environment, connections, preferences etc.
  – Proactively serve up the most appropriate content, product or service

• Mobile instant messaging (MIM)
  – Skype for mobiles

• Mobile e-mail

• Mobile video
### Variety of languages and platforms to choose from

<table>
<thead>
<tr>
<th>Platform</th>
<th>Programming language</th>
<th>Debuggers available</th>
<th>Emulator available</th>
<th>Integrated development environment available</th>
<th>Cross-platform deployment</th>
<th>Installer packaging options</th>
<th>Development tool cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe AIR</td>
<td>ActionScript, HTML, CSS, JavaScript</td>
<td>Yes</td>
<td>Yes</td>
<td>Flash Builder, Flash Professional</td>
<td>iOS (iPhone, iPad, iPod touch), Android, BlackBerry</td>
<td>The native distribution format of each platform</td>
<td>Flash Builder, Flash Professional - Commercial licenses available Adobe AIR SDK (command line tool)</td>
</tr>
<tr>
<td>Airplay SDK (Now Marmalade)</td>
<td>C, C++</td>
<td>Yes</td>
<td>Yes</td>
<td>Visual Studio, XCode</td>
<td>All native: Android, BlackBerry, BREW, iOS (iPhone), Maemo, Palm/webOS, Samsung bada, Symbian, Windows Mobile 6.x and desktop, OSX</td>
<td>The native distribution format of each platform</td>
<td>Commercial licenses available</td>
</tr>
<tr>
<td>alcheMo</td>
<td>Java</td>
<td>Yes</td>
<td>Yes</td>
<td>Visual Studio, Eclipse, XCode</td>
<td>Android, BREW, iOS (iPhone), Windows Mobile</td>
<td>The native distribution format of each platform</td>
<td>Commercial licenses available</td>
</tr>
<tr>
<td>Android</td>
<td>Java but portions of code can be in C, C++</td>
<td>Yes, in Eclipse, standalone debugging monitor available</td>
<td>Yes, in Eclipse, standalone debugging monitor available</td>
<td>Eclipse, Project Kanai Android plugin for NetBeans</td>
<td>Android only, because of Dalvik VM, March 2009</td>
<td>apk</td>
<td>Free</td>
</tr>
<tr>
<td>Appcelerator</td>
<td>JavaScript</td>
<td>Yes</td>
<td>No</td>
<td>Sathish Srinivas Internal SDK</td>
<td>Android, iPhone, BlackBerry, Blackberry</td>
<td>The native distribution format of each platform</td>
<td>Apache 2.0 License, commercial licenses</td>
</tr>
</tbody>
</table>
Popular platforms – Market share

http://en.wikipedia.org/wiki/Mobile_operating_system
The devices we use
GENERAL TOPICS OF INTEREST
Mobile Web Services

- Provisioning of services from the smart phones
- Invocation of web services from smart phones
- Mobile web service discovery
- Addressing mobiles in 3G/4G networks
- Push notification mechanisms
- Mobile positioning
  - Indoor and Outdoor

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Green software

• Measuring the energy requirements of software & android apps
  – Sustainability aware software programming

• To evaluate the impact of code smell refactoring on power consumption of android apps

[Hindle et al, MSR 2014]

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Mobile Cloud Computing

• One can do interesting things on mobiles directly
  – Today’s mobiles are far more capable
  – We can even provide services from smart phones

• However, some applications need to offload certain activities to servers
  – Processing sensor data

• Resource-intensive processing on the cloud
  – To enrich the functionality of mobile applications
Mobile Cloud Access Schemes

Delegation

[Flores & Srirama, JSS 2014]

Code Offloading

[Flores et al, IEEE Communications 2015]

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Code offloading

• Decision making
  – When is it ideal to offload a task from mobile to cloud?
  – Fuzzy logic
  – Linear Programming

• Code offloading still have adaptability issues
  [Srirama, CSIICT 2017]
  – Incentive mechanisms for code offloading
Adaptive Workflow Mediation Framework

• Task delegation is a reality!!!
  – Cloud providers also support different platforms
• Mobile Host allows invocation of services on smartphones
• So Peer-to-Peer (P2P) communication is possible
• Extended the Mobile Host to also support workflow execution [Chang et al, ICSOC 2012; MUM 2014]
  – To address challenges of discovery and quality of service (QoS) [Srirama et al, MW4SOC 2007]
  – Tasks can move between mobile and middleware

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Internet of Things (IoT)

• “The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service.” [European Research Cluster on IoT]

• More connected devices than people

• Cisco believes the market size will be $19 trillion by 2025

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2/15/2018

Source: Cisco IBSG, April 2011
IoT - Scenarios

- Environment Protection
- Smart Home

[Kip Compton] [Perera et al, TETT 2014]


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Internet of Things – Challenges

How to provide energy efficient services?

How do we communicate automatically?

Sensors

Tags

Mobile Things

Appliances & Facilities

How to interact with ‘things’ directly?

[Chang et al, ICWS 2015]

[Chang et al, SCC 2015; Liyanage et al, MS 2015]
Cloud-based IoT

Remote Cloud-based processing

Connectivity nodes & Embedded processing

Sensing and smart devices

Proxy

Storage

Processing
Research focus for the semester in IoT

- We have established IoT and Smart Solutions Lab with Telia company support

- Interesting topics
  - Discovery of IoT devices
  - Working with IoT based devices
  - Study of available IoT platforms
    - Amazon IoT
    - Open IoT

- IoT-based smart cities

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Issues with Cloud-centric IoT

• Latency issues for applications with sub-second response requirements
• Certain scenarios do not let the data move to cloud
• Fog computing [Chang et al, AINA 2017; Mass et al, SCC 2016]
  – Processing across all the layers, including network switches/routers
• Mist computing
  – Processing at the edge devices
  – Dynamic provisioning of a platform for process execution [Liyanage et al, PDCAT 2016]
    • E.g. Android-portied Activiti BPM engine (http://activiti.org)
Ongoing Research in Fog Computing

- Mobility, task migration, discovery, scalability and containerisation
  [Soo et al, IJMCMC 2017]

- QoE-aware application placement across Fog topology  [Mahmud et al, JPDC 2018 (Second revision)]

- Indie Fog  [Chang et al, IEEE Computer 2017]
  – System architecture for enabling Fog computing with customer premise equipment
  
QoE – Quality of Experience  

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Research Roadmap – IoT & Fog Computing

Distributed data processing on the Cloud
E.g. MapReduce, Spark

Distributed data processing across the Cloud and Fog layers
E.g. Personalized data, privacy etc.

Fog topology management and scheduling the tasks
E.g. tasks run across the fog topology such as stream data processing, smart streetlights etc.

Edge analytics
E.g. filter, error detection, consolidation etc.

Intelligent sensors
E.g. vehicular networks

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WE ALWAYS WELCOME NEW IDEAS!
Course Schedule

• Today we introduce you the projects
• Lecture 2 (22.02)
  – Second meeting to finalize the topics
• Lecture 3 (01.03)
  – Deadline for choosing a project
  – Presentation by students about their topics
  – Deliver a preliminary report of the project
    • Meaningful report explaining (architecture, design, similar solutions etc.)
• Remaining schedule will be notified later
Project selection

• Projects are available at
  https://courses.cs.ut.ee/2018/MADP/spring/Main/Projects

• Responsible persons
  – Satish Srirama (srirama AT ut DOT ee)
  – Chii Chang (chang AT ut DOT ee)
  – Mohan Liyanage (liyanage AT ut DOT ee)
  – Jakob Mass (jaks AT ut DOT ee)
THANK YOU

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